

(MATHEMATICS)

SPECIAL DPP

DPP-1

- Q.1** If $P(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + dx + c$, where $ac \neq 0$, then $P(x) \cdot Q(x) = 0$ has
 (A) exactly one real root (B) atleast two real roots
 (C) exactly three real roots (D) all four are real roots.
- Q.2** If α, β are the roots of the equation $x^2 + px - r = 0$ and $\frac{\alpha}{3}, 3\beta$ are the roots of the equation $x^2 + qx - r = 0$, then r equals
 (A) $\frac{3}{8}(p - 3q)(3p + q)$ (B) $\frac{3}{8}(p + 3q)(3p - q)$
 (C) $\frac{3}{64}(3p - q)(p - 3q)$ (D) $\frac{3}{64}(3q - p)(p - q)$
- Q.3** Let λ_1 and λ_2 be two values of λ for which the expression $x^2 + (2 - \lambda)x + \lambda - \frac{3}{4}$ becomes a perfect square. The value of $(\lambda_1^2 + \lambda_2^2)$ equals
 (A) 8 (B) 25 (C) 50 (D) 100
- Q.4** The value of the expression $x^4 - 8x^3 + 18x^2 - 8x + 2$ when $x = \cot \frac{\pi}{12}$, is
 (A) 2 (B) 1 (C) 0 (D) 3
- Q.5** If e^λ and $e^{-\lambda}$ are the roots of equation $3x^2 - (a + b)x + 2a = 0$, $a, b, \lambda \in \mathbb{R}, \lambda \neq 0$ then least integral value of b is
 (A) 4 (B) 5 (C) 9 (D) 10
- Q.6** Let x_1 and x_2 be the roots of the quadratic equation $x^2 + px + q = 0$.
 If $x_1 = \frac{x_2 + 4}{2x_2 - 1}$, then the value of $(2q + p)$ is equal to
 (A) 1 (B) 2 (C) 3 (D) 4
- Q.7** If α, β are the roots of the quadratic equation $x^2 + 2(1 - \cos 3\theta)x - 2\sin^2 3\theta = 0$ ($\theta \in \mathbb{R}$), then the maximum value of $\alpha^2 + \beta^2$ is equal to
 (A) 0 (B) 4 (C) 8 (D) 16
- Q.8** If $(a + b + c) > 0$ and $a < 0 < b < c$, then the equation $a(x - b)(x - c) + b(x - c)(x - a) + c(x - a)(x - b) = 0$ has
 (A) real and distinct roots (B) roots are imaginary
 (C) product of roots is negative (D) product of roots is positive
- Q.9** If one of the root of the equation $4x^2 - 15x + 4p = 0$ is the square of the other then the value of p is
 (A) $125/64$ (B) $-27/8$ (C) $-125/8$ (D) $27/8$
- Q.10** Consider the quadratic equation $(k^2 - 1)x^2 + (2k^3 + 9k^2 + 3k - 14)x + (2k^3 + 5k^2 - 11k - 14) = 0$ then find the the sum of all the value(s) of k (where $k \in \mathbb{R}$) for which the given equation has
- | Column-I | Column-II |
|--|--------------------|
| (A) Exactly one root zero and other root is finite | (P) -1 |
| (B) Both roots zero | (Q) $-\frac{5}{2}$ |
| (C) Exactly one root infinity | (R) 2 |
| (D) Both roots infinity | (S) $-\frac{7}{2}$ |
| | (T) 1 |

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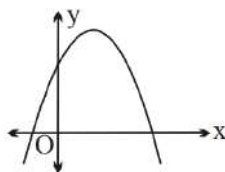
DPP-1(Answer Key)

1. (B) 2. (C) 3. (C) 4. (B) 5. (B) 6. (D) 7. (D)
8. (A, C) 9. (C, D) 10. $A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow T$



DPP-2

Q.1 The graph of a quadratic polynomial $y = px^2 - qx + r$ is as shown in the adjacent figure, then



- (A) $r^2 - 4q < 0$ (B) $r^2 - 4p < 0$ (C) $p + q > 0$ (D) $r - p - q > 0$

Q.2 The smallest integral value of p for which the inequality $(p - 3)x^2 - 2px + 3(p - 2) > 0$ is satisfied for all real values of x , is

- (A) 8 (B) 7 (C) 6 (D) 5

Q.3 The complete solution set of the inequality $\frac{3^x(2x-5)(x^2+x+2)}{(\cos x-2)(x^2+x)} \leq 0$ is

- (A) $(-\infty, -1)$ (B) $(\frac{5}{2}, \infty)$ (C) $(-1, \frac{5}{2}]$ (D) $(-1, 0) \cup [\frac{5}{2}, \infty)$

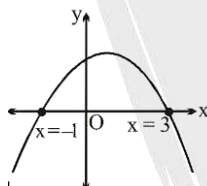
Q.4 If the graph of $f(x) = x^2 + (3 - k)x + k$, (where $k \in \mathbb{R}$) lies above and below x -axis, then k cannot be

- (A) -1 (B) 0 (C) 1 (D) 10

Q.5 The largest integral value of k for which the quadratic trinomial $P(x) = (k - 2)x^2 + 8x + k + 4$ is non-positive for all real values of x is

- (A) 2 (B) 4 (C) -6 (D) -2

Q.6 Consider the graph of quadratic polynomial $y = ax^2 + bx + c$ as shown below. Which of the following is(are) correct?



- (A) $\frac{a-b+c}{abc} = 0$ (B) $abc(9a + 3b + c) < 0$
(C) $\frac{a+3b+9c}{abc} < 0$ (D) $ab(a - 3b + 9c) > 0$

Q.7 If S is the set of all real 'x' such that $\frac{x^2(5-x)(1-2x)}{(5x+1)(x+2)}$ is negative and $\frac{3x+1}{6x^3+x^2-x}$ is positive, then S contains

- (A) (1,4) (B) (5,11) (C) $(-\frac{3}{2}, \frac{-1}{2})$ (D) (-10, -4)

Q.8 Let $f(x) = x^2 + px - 2$, $g(x) = px^2 + x + (p + 2) \forall x \in \mathbb{R}$, where p is a real constant.

If $f(x) > g(x) \forall x \in \mathbb{R}$, then the range of p is $(-\infty, -\frac{m}{n})$ where m and n are coprime. Find the value of $(m - 5n)$.

Q.9 Let $x^2 + 2y^2 - 2xy - 2 \geq k(x + 2y) \forall x, y \in \mathbb{R}$ then find the number of integral values of k .

Q.10 If the roots of the equation $x^2 + (p + 1)x + 2q - q^2 + 3 = 0$ are real and unequal $\forall p \in \mathbb{R}$ then find the minimum integral value of $(q^2 - 2q)$.

DPP-2

1. (D) 2. (B) 3. (D) 4. (C) 5. (C) 6. (A, C)
7. (A, C) 8. (2) 9. (0) 10. (4)



(MATHEMATICS)

SPECIAL DPP

DPP-3

- Q.1** A monic quadratic trinomial $P(x)$ is such that $P(x) = 0$ and $P(P(P(x))) = 0$ have a common root, then
 (A) $P(0) \cdot P(1) > 0$ (B) $P(0) \cdot P(1) < 0$
 (C) $P(0) \cdot P(1) = 0$ (D) none
- Q.2** If two roots of the equation $(x - 1)(2x^2 - 3x + 4) = 0$ coincide with roots of the equation $x^3 + (a + 1)x^2 + (a + b)x + b = 0$ where $a, b \in \mathbb{R}$ then $2(a + b)$ equals
 (A) 4 (B) 2 (C) 1 (D) 0
- Q.3** If $c^2 = 4d$ and the two equations $x^2 - ax + b = 0$ and $x^2 - cx + d = 0$ have one common root, then the value of $2(b + d)$ is equal to
 (A) $\frac{a}{c}$ (B) ac (C) $2ac$ (D) $a + c$
- Q.4** If one root of quadratic equation $x^2 - x + 3m = 0$ is 4 times the root of the equation $x^2 - x + m = 0$, where $m \neq 0$, then m equals
 (A) $\frac{12}{196}$ (B) $\frac{12}{169}$ (C) $\frac{12}{256}$ (D) $\frac{12}{189}$
- Q.5** If the equations $x^3 + x^2 - 4x = 4$ and $x^2 + px + 2p = 0$ ($p \in \mathbb{R}$) have two roots common, then the value of p is
 (A) -2 (B) -1 (C) 1 (D) 3
- Q.6** **Statement-1:** If the equations $a^2 + bx + c = 0$ ($a, b, c \in \mathbb{R}$ and $a \neq 0$) and $2x^2 + 7x + 10 = 0$ have a common root, then $\frac{2a+c}{b} = 2$.
Statement-2: If both roots of $a_1x^2 + b_1x + c_1 = 0$ and $a_2x^2 + b_2x + c_2 = 0$ are same, then $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. Given $a_1, b_1, c_1, a_2, b_2, c_2 \in \mathbb{R}$ and $a_1a_2 \neq 0$.
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.
- Q.7** If all the equations $x^2 + px + 10 = 0$, $x^2 + qx + 8 = 0$ and $x^2 + (2p + 3q)x + 60 = 0$, where $p, q \in \mathbb{R}$ have a common root, then the value of $(p - q)$ can be
 (A) -1 (B) 0 (C*) 1 (D) 2
- Q.8** If quadratic equations $2x^2 - 3x + 5 = 0$ and $ax^2 - bx + c = 0$, $a, b, c \in \mathbb{N}$ have a common root then the value of $a + b + c$ can be equal to
 (A) 10 (B) 15 (C) 20 (D) 25
- Q.9** The equations $x^3 + 4x^2 + px + q = 0$ and $x^3 + 6x^2 + px + r = 0$ have two common roots, where $p, q, r \in \mathbb{R}$. If their uncommon roots are the roots of equation $x^2 + 2ax + 8c = 0$, then
 (A) $a + c = 8$ (B) $a + c = 2$ (C) $3q = 2r$ (D) $3r = 2q$
- Q.10** If $x^2 + 3x + 5$ is the greatest common divisor of $(x^3 + ax^2 + bx + 1)$ and $(2x^3 + 7x^2 + 13x + 5)$ then find the value of $[a + b]$.
[Note: $[k]$ denotes greatest integer less than or equal to k .]

DPP-3(Answer Key)

1. (C) 2. (C) 3. (B) 4. (B) 5. (B) 6. (A) 7. (A, C)
8. (A, C) 9. (A, C) 10. (8)



- Q.1** If $x \in \mathbb{R}$ then range of $f(x) = \frac{x^2+2x-3}{2x^2+3x-9}$ is
 (A) $(-\infty, \infty)$ (B) $\mathbb{R} - \left\{\frac{1}{2}\right\}$ (C) $\mathbb{R} - \left\{\frac{4}{9}, \frac{1}{2}\right\}$ (D) $\mathbb{R} - \left\{\frac{3}{2}\right\}$
- Q.2** If the highest point on the graph of $y = -x^2 - 2kx + 3a$ is $(-1, 2)$ then the value of $(k + 6a)$ is
 (A) 2 (B) 3 (C) 5 (D) 6
- Q.3** If the quadratic polynomial $f(x) = (a - 3)x^2 - 2ax + 3a - 7$ ranges from $[-1, \infty)$ for every $x \in \mathbb{R}$, then the value of a lies in
 (A) $[0, 2]$ (B) $[3, 5]$ (C) $[4, 6]$ (D) $[5, 7]$
- Q.4** The sum of all integral values in the range of $P(t)$ is
 (A) 19 (B) 20 (C) 21 (D) 22
- Q.5** If $Q(x) + 54 \geq P(t) \forall x \in \mathbb{R}$ then true set of values of m is
 (A) $[-1, 6]$ (B) $[-6, 1]$ (C) $[-7, 1]$ (D) $[-1, 7]$
- Q.6** The value of $f(0) + 2f(1)$ is equal to
 (A) 45 (B) 26 (C) 24 (D) 20
- Q.7** If α be one of the root of $f(x) = 0$ then the value of $(\alpha^3 + 10\alpha^2 + 40\alpha + 39)$ is
 (A) 0 (B) 9 (C) 10 (D) -9
- Q.8** Range of $h(x) = \left(\frac{3}{2} + a\right)x^2 + (b - 1)x + (c - 6)$ when $x \in [-2, 0]$ is
 (A) $\left[\frac{39}{8}, 6\right]$ (B) $\left[\frac{39}{8}, 8\right]$ (C) $[6, 8]$ (D) $\left[\frac{39}{8}, \infty\right)$
- Q.9** If $\sin^2 x + \sin x = (a + 2)$, then which of the following statement(s) is(are) correct?
 (A) Number of integral values of a for real solution to exist is 3.
 (B) There exists no solution for $a < \frac{-9}{4}$ or $a > 0$.
 (C) The minimum value of a for real solution is -2.
 (D) Number of prime values of a for real solution to exist is 1.
- Q.10** Let $f(x) = x^2 + bx + c$ ($b, c \in \mathbb{R}$) for all $x \in \mathbb{R}$, attains its least value at $x = -1$ and the graph of $f(x)$ cuts y -axis at $y = 2$. Then
 (A) the least value of $f(x)$ for all $x \in \mathbb{R}$ is 1.
 (B) the value of $f(-2) + f(0) + f(1)$ equals 9.
 (C) the least value of $f(x)$ for all $x \in \mathbb{R}$ is -1.
 (D) the value of $f(-2) + f(0) + f(1)$ equals 7.

DPP-4(Answer Key)

Q.1 (C) Q.2 (B) Q.3 (D) Q.4 (B) Q.5 (D) Q.6 (A) Q.7 (D)
Q.8 (B) Q.9 (A,B) Q.10 (A,B)



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DPP-5

- Q.1** Let $P(x) = x^3 - 6x^2 + Bx + C$ has $1 + 5i$ as a zero and B, C are real numbers, then value of $(B + C)$ is
 (A) -70 (B) 70 (C) 24 (D) 138
- Q.2** If the equation $x^3 + 2x^2 - 4x + 5 = 0$ has roots α, β and γ , then the value of $\frac{(\alpha^3+5)(\beta^3+5)(\gamma^3+5)}{13\alpha\beta\gamma}$ is equal to
 (A) 5 (B) 8 (C) 12 (D) 15
- Q.3** Let α, β, γ and δ be the roots (real or non-real) of equation $x^4 - 3x + 1 = 0$. The value of $\alpha^3 + \beta^3 + \gamma^3 + \delta^3$ is equal to
 (A) 6 (B) 9 (C) 12 (D) 15
- Q.4** If the general expression of degree 2 given by $3x^2 + xy + ky^2 + 10x - 3y + 7$ can be factorised into two linear factors then value of k is
 (A) 4 (B) 2 (C) -2 (D) -4
- Q.5** If α, β, γ are roots of cubic equation $x^3 - 3x^2 + 2x + 4 = 0$ and $y = 1 + \frac{\alpha}{x-\alpha} + \frac{\beta x}{(x-\alpha)(x-\beta)} + \frac{\gamma x^2}{(x-\alpha)(x-\beta)(x-\gamma)}$ then the value of y at $x = 2$, is
 (A) 0 (B) 1 (C) 2 (D) 3
- Q.6** The value of k is equal to
 (A) 27 (B) 0 (C) -9 (D) 3
- Q.7** The minimum value of $f(x) = x^2 + \alpha x + \beta, x \in \mathbb{R}$ is equal to
 (A) $\frac{-23}{3}$ (B) $\frac{23}{12}$ (C) $\frac{-23}{12}$ (D) $\frac{23}{3}$
- Q.8** The value of expression $(\alpha^{-2} + \beta^{-2} + \gamma^{-2})$ is equal to
 (A) $\frac{83}{9}$ (B) $\frac{84}{9}$ (C) $\frac{82}{9}$ (D) $\frac{85}{9}$
- Q.9** Let roots of the equation $x^3 + 3x^2 + 4x = 11$ are α, β, γ and the roots of equation $x^3 + lx^2 + mx + n = 0 (l, m, n \in \mathbb{R})$ are $\alpha + \beta, \beta + \gamma, \gamma + \alpha$.
Column-I **Column-II**
 (A) l is equal to (P) -6
 (B) m is equal to (Q) 6
 (C) n is equal to (R) 13
 (D) $(l + m + n)$ is equal to (S) 23
 (T) 42
- Q.10** If the system of equation $r^2 + s^2 = t$ and $r + s + t = \frac{k-3}{2}$ has exactly one real solution, then find the value of k .

(MATHEMATICS)

SPECIAL DPP

DPP-5(Answer Key)

Q.1 (A) Q.2 (B) Q.3 (B) Q.4 (D) Q.5 (C) Q.6 (A) Q.7 (C)
Q.8 (A) Q.9 (A) Q; (B) R; (C) S; (D) T Q.10 0002

A

DPP-6

- Q.1** The range of $p \in \mathbb{R}$ for which the equation $2x^2 - 2(2p + 1)x + p(p + 1) = 0$ have one root less than p and other root greater than p , is
 (A) $-1 < p < 0$ (B) $p < -1$ or $p > 0$
 (C) $p \geq 0$ (D) $p = 0$
- Q.2** If exactly one root of the quadratic equation $x^2 - \left(k + \frac{11}{3}\right)x - (k^2 + k + 1) = 0$ lies in $(0, 3)$ then which one of the following relation is correct?
 (A) $-8 < k < -4$ (B) $-3 < k < -1$
 (C) $1 < k < 4$ (D) $6 < k < 10$
- Q.3** If the equation $x^2 + ax + b = 0$ has one root equal to unity and other root lies between roots of the equation $x^2 - 7x + 12 = 0$, then the range of a is
 (A) $(-5, -4)$ (B) $(-4, -3)$ (C) $(-3, -2)$ (D) $(4, 5)$
- Q.4** The greatest integral value of p for which the quadratic equation $x^2 - p(2x - 8) = 15$ has one root less than 1 and other root greater than 2, is
 (A) -1 (B) 0 (C) 1 (D*) 2
- Q.5** Let $P(x) = x^2 - 2(a^2 + a + 1)x + a^2 + 5a + 2$. If minimum value of $P(x)$ for $x \leq 0$ is 8, then the sum of the squares of all possible value(s) of a , is
 (A) 13 (B) 17 (C) 37 (D) 49
- Q.6** If $\lambda, p \in \mathbb{R}$ and $p \in [-5, 10]$ then the number of integral value of 'p' for which $e^\lambda + 1$ and $e^{-\lambda} + 1$ are the roots of the quadratic equation $x^2 + (1 - 2p)x + 2p - 1 = 0$ is
 (A) 7 (B) 8 (C) 14 (D) 16
- Q.7** If α, β are the roots of equation $x^2 - 3x + c = 0$ ($c \in \mathbb{R}$) and $\alpha < 1 < \beta$, then c belongs to
 (A) $\left(-\infty, \frac{9}{4}\right)$ (B) $(-\infty, 2)$ (C) $(2, \infty)$ (D) $\left(\frac{9}{4}, \infty\right)$
- Q.8** Let $f(x) = x^2 - 6kx + k^2 + 6k$, $k \in [-5, 5]$ and $x \in \mathbb{R}$. If both roots of the equation $f(x) = 0$ are greater than unity and minimum integral value of $f(1)$ is β , then
 (A) $\beta = 1$ (B) $\beta = 2$
 (C) number of integral values of k is 4. (D) number of integral values of k is 5.
- Q.9** If $\alpha + \frac{1}{\alpha}$ and $2 - \beta - \frac{1}{\beta}$ ($\alpha, \beta > 0$) are the roots of the quadratic equation $x^2 - 2(a + 1)x + a - 3 = 0$ then find the sum of integral values of 'a'.
- Q.10** If α, β are the roots of the quadratic equation,
 $(a^2 - 4a + 3)x^2 - (a^3 - 8a - 1)x + \log_{1/2}(a^2 - 6a + 9) = 0$
 such that $\alpha < 0 < \beta$ then the range of a is $(-\infty, p) \cup (q, r) \cup (s, \infty)$. Find the value of $(p + q + r - s)$.

DPP-6

Q.1 (B) Q.2 (B) Q.3 (A) Q.4 (D) Q.5 (C) Q.6 (B) Q.7 (B)
Q.8 (B) (D) Q.9 0005 Q.10 2



(MATHEMATICS)

SPECIAL DPP

DPP-7

- Q.1** If the equation $|1 - x| - |x + 2| + x = p$ has two distinct real solutions then
 (A) $p \in (-2, 1)$ (B) $p \in [-2, 1]$ (C) $p \in \{-1, 2\}$ (D) $p \in \{-2, 1\}$
- Q.2** The smallest integral value of α for which the inequality $1 + \log_5(x^2 + 1) \leq \log_5(\alpha x^2 + 4x + \alpha)$ is true for all $x \in \mathbb{R}$, is
 (A) 4 (B) 5 (C) 6 (D) 7
- Q.3** The number of integral solution(s) of the inequality $\log_{(x^2+2)}(x^4 + x^2 + 2) \geq \sqrt{2 - \log_3(3 + |x|)}$ is
 (A) 0 (B) 1 (C) 6 (D) 13
- Q.4** If the equation $|x^2 + 2x + a| = 2$ has exactly 4 real and distinct solutions, then
 (A) $a > 3$ (B) $a \in (-\infty, -1] \cup (2, \infty)$
 (C) $a \in (-\infty, 1) \cup (3, \infty)$ (D) $a < -1$
- Q.5** The number of integral value(s) of x satisfying both the inequalities $\log_{\sqrt{5}}(4 - x) \geq 0$ and $\log_{(x-1)}(x^2 + 2) \geq 0$ is
 (A) 1 (B) 2 (C) 3 (D) 4
- Q.6** For $2 < x < 5$, the expression $|2x - 1| + |5 - 3x| + |x - 6| = Ax + B$. The value of $A + B$, is
 (A) 2 (B) 4 (C) 8 (D) 10
- Q.7** Column-I Column-II
 (A) The possible integer(s) satisfying the inequality $\log_{(2x-3)}(3x - 4) > 0$, is (P) 2
 (B) The possible integer(s) satisfying the inequality $\log_{\tan \frac{\pi}{6}}\left(\frac{x^2 - x + 1}{x + 2}\right) > -2$, is (Q) 3
 (C) The possible integer(s) satisfying the inequality $\log_{0.5}(x^2 - 3x + 4) - \log_{0.5}(x - 1) + 1 < 0$, is (R) 4
 (S) 5
- Q.8** Find the number of integral values of x satisfying the inequality $\log_4\left(\frac{2x-1}{x+1}\right) \leq \cos\left(\frac{4\pi}{3}\right)$. [Ans. 1]
- Q.9** Find the smallest value of $\left(\frac{-8p}{7}\right)$ for which $|x^2 - 5x + 7 - p| = 6 + |x^2 - 5x + 1 - p|$ for all $x \in [-1, 3]$.
- Q.10** Find the number of integral solutions of the inequation $\log_9(x + 1) \cdot \log_2(x + 1) - \log_9(x + 1) - \log_2(x + 1) + 1 < 0$.

DPP-7

Q.1 (D) Q.2 (D) Q.3 (D) Q.4 (D) Q.5 (A) Q.6 (B)

Q.7 (A) Q, R, S; (B) P, Q, R; (C) R, S Q.8 1 Q.9 0006

Q.10 0006

